April 25, 2012

Mr. Chris Hill
Environmental Engineer
Chesapeake Energy Corporation
P.O. Box 18496
Oklahoma City, Oklahoma 73154-0496

Re: Proposal/Cost Estimate
Limited Hydrogeological Investigation
Hydraulic Fracturing Prospective Case Study
NE/4 Section 15, Township 28 North, Range 11 West
Alfalfa County, Oklahoma

Dear Mr. Hill:

SAIC Energy, Environment & Infrastructure, LLC (SAIC), is pleased to present Chesapeake Energy Corporation (Chesapeake) the following Proposal/Cost Estimate to conduct a Limited Hydrogeological Investigation (Investigation) to support the Hydraulic Fracturing Prospective Case Study proposed in the NE/4 of Section 15, Township 28 North, Range 11 West, Alfalfa County, Oklahoma (Site). The Investigation is being conducted to evaluate the Site soil and groundwater background conditions prior to construction of a pad site for gas well drilling/development. Groundwater contained within the Quaternary-age terrace deposits underlie the well pad area, and have been identified as a major alluvial aquifer that is used for agricultural, municipal and domestic purposes. The bedrock (Permian-age) groundwater that underlies the terrace deposits in the area will also be evaluated. The bedrock formations in this area contain naturally-occurring poor water quality of low yield and therefore, groundwater is not typically used from bedrock formations in this area. However, this investigation will evaluate that portion of the bedrock groundwater system that is above the base of treatable groundwater (i.e., groundwater with a TDS of 10,000 mg/L or less). The base of treatable groundwater in the well pad area has initially been determined to be 100 to150 feet below ground level (bgl) by the Oklahoma Corporation Commission (OCC). The base of treatable groundwater will occur within the Hennessey Group bedrock units. The main objectives of this Investigation will be to: 1) determine the groundwater flow direction and collect hydraulic parameters to estimate groundwater velocity; 2) determine the subsurface geology and groundwater occurrence beneath the Site; 3) collect initial soil samples for limited analytical testing; 4) collect 1 round of groundwater samples for comprehensive analytical testing; and 5) define the variation of groundwater quality with depth within the terrace and bedrock groundwater systems.

Surficial geology at the Site consists of Quaternary-age terrace deposits related to the Salt Fork of the Arkansas River. These deposits consist of light-tan to gray gravel, sand, silt, clay, and volcanic ash, with sand dunes common in places. A review of water well data from wells located within approximately 2 miles of the Site indicates that the terrace deposits at the Site likely range from 20 to 50 feet in thickness and average approximately 35 feet in thickness. Groundwater in the terrace deposits in this area are reported to range from approximately 3 feet bgl to 28 feet bgl, and average approximately 15 feet bgl. Underlying the terrace deposits is Permian-age consolidated bedrock of the Hennessey Group, which includes the Bison Formation, Salt Plains Formation, Kingman Formation, and Fairmont Shale. These units consist of fine-grained sandstone, siltstone, and shale. The Bison Formation is approximately 120 feet thick, the Salt Plans Formation is approximately 160

O:\Enviro\TUL\PROPOSAL\2012\2602299041-_CHK_AlfalfaCo\Ltd Hydr Invest Prop 4-25-2012.docx feet thick, the Kingman Formation is approximately 70 feet thick, and the Fairmont Shale is approximately 160 feet thick, with a collective thickness of approximately 510 feet. Groundwater in the consolidated bedrock occurs principally within fractures and joints and is typically of very poor quality, becoming more mineralized with depth.

During implementation of the Investigation, SAIC anticipates implementing the following activities on behalf of Chesapeake:

Task 1 - Project Management
The Investigation activities will be managed out of SAIC's Tulsa, Oklahoma office by Mr. Bruce McKenzie. SAIC's on-site hydrogeologist will be Mr. Matt Mugavero, and SAIC technicians will include either Mr. Stan Marshall or Mr. Terry Fisher as schedules allow. QA/QC of the laboratory analytical data will be managed by Ms. Kristin Drucquer. SAIC will prepare a Site-Specific Health and Safety Plan (HSP) that will address all field activities proposed herein.

Task 2 - Monitoring Well Installation and Development
A total of 6 groundwater monitoring wells, 5 shallow (~50 feet) and 1 deep (~150 feet), will be installed to establish and monitor the groundwater quality at or in close proximity to the proposed well pad site. These monitoring wells will be drilled and installed by a licensed well driller (Associated Environmental Industries, Inc., Norman, Oklahoma) in accordance with Oklahoma state regulations.

The shallow groundwater monitoring wells will be installed utilizing a truck-mounted hollow-stem auger drilling rig and CME continuous split-barrel sample system from surface to total depth. Borings will be advanced to the top of the underlying consolidated bedrock. During drilling, lithological descriptions will be made using the Unified Soil Classification System. Field activities will be recorded in a dedicated field logbook, and all hydrogeological information noted documented on permanent soil boring records.

In each borehole, soil samples will be collected from the following depth intervals: 0-0.5 feet bgl, 1-2 feet bgl and 2-3 feet bgl. Upon collection, the soil samples will be placed into laboratory prepared containers, labeled as to source and contents, placed on wet-ice for preservation, and placed under chain-of-custody control for transport to the analytical laboratory (TestAmerica, Inc., Nashville, TN) for volatile organic compound (VOC) (SW 8260B), semi-volatile organic compound (SVOC) (SW 8270C), polycyclic aromatic hydrocarbon (PAH) (SW 8270C-SIM) and total petroleum hydrocarbon (TPH) (TX 1005) analyses. In addition to soil samples for laboratory analysis, an aliquot of each soil sample will be submitted to a soils laboratory (Inter-Mountain Laboratories, Inc., Sheridan, Wyoming) for comprehensive salinity analysis by Saturated Paste Extraction (Cations: sodium, calcium, magnesium, potassium; Anions: nitrate-n, chloride, sulfate, boron, bicarbonate, carbonate; General Chemistry: pH, conductivity, texture; Derived Values: total soluble salts, sodium adsorption ratio, potassium adsorption ratio, exchangeable sodium percentage, exchangeable potassium percentage).

The shallow monitoring wells will be constructed using 2-inch diameter, screw-coupled, Schedule 40 PVC 0.010-inch slot screens and Schedule 40 PVC casing. In general, approximately 30 to 40 feet of screen will be installed in each monitor well such that the top of the screen is situated above (approximately 5 feet) the groundwater saturation level observed at the time of well installation. Once the screen/casing strings are positioned within the open boreholes, a clean silica sand pack will be placed in the annular space between the screen/casing and the open borehole. In each monitor well, the sand pack will extend from total depth to approximately two feet above the top slot of the screen. A 2-foot minimum sodium bentonite pellet seal will be placed immediately above the sand packs. Following hydration of the bentonite seal, the remaining annular space will be filled with a cement/bentonite grout using pressure-grouting techniques to approximately one foot bgl. A vented cap will be placed on top of the well casing, and a locking steel protective outer casing will be centered upon each well casing. The protective outer casing will be set in a 3-inch thick by 36-inch diameter concrete pad. During well completion, the well identification nomenclature will be placed on or in the well protector. When the well pads have cured, a weep hole will be drilled in each protective outer casing just above the concrete pad so that moisture will not accumulated within the protective outer casing. Well completion details will be recorded on permanent well completion records.

The deep monitoring well will be installed by drilling through the terrace deposits and 5 feet into the underlying bedrock utilizing a truck-mounted hollow-stem auger drilling rig and CME continuous split-barrel sample system. A 10-inch diameter surface casing will then be set and grouted in-place to isolate the groundwater within the terrace deposits from the groundwater within the underlying bedrock. Once the surface casing grout has cured, air-rotary drilling equipment will be utilized to drill into the underlying bed rock. During bedrock drilling operations, an attempt will be made to collect water quality measurements (i.e., specific conductivity, temperature and pH) from the borehole as these data may be useful in determining the base of treatable water.

Upon reaching total depth, geophysical and water quality logging will be conducted in the deep borehole. The geophysical and water quality logging will be conducted by Century Geophysical Corporation and Earth Data Northeast, Inc., respectively, and will include the following:

- Caliper,
- Natural Gamma,
- Normal Resistivity,
- Single Point Resistance,
- Fluid Resistivity and Temperature,
- Spontaneous Potential (SP),
- Induction Conductivity,
- Magnetic Susceptibility,
- Full Wave Form Sonic,
- Acoustic Borehole Imager with Vertical Deviation and Azimuth,
- Neutron Density,
- Gamma-Gamma Density, and
- Water Quality Logging (pressure, temperature, conductivity, dissolved oxygen, pH and Eh).

The deep monitoring well will be constructed using 4-inch diameter, screw-coupled, Schedule 40 PVC 0.010-inch slot screens and Schedule 40 PVC casing. Approximately 80 to 100 feet of screen will be installed so that the top of the screened interval will terminate at, or just above, the top of the groundwater zone to be monitored. Once the screen/casing assembly is positioned within the borehole, the annular space between the wellbore and the screen/casing will be filled with clean, silica sand to a level approximately two feet above the top slot of the screened interval. Four feet of bentonite will then be placed in the annular space above the silica sand/filter pack and hydrated. Following hydration of the bentonite seal, the remaining annular space will be filled with a cement/bentonite grout using pressure-grouting techniques to approximately one foot bgl. A vented cap will be placed on top of the well casing, and a locking steel protective outer casing will be centered upon the well casing. The protective outer casing will be set in a 3-inch thick by 36-inch diameter concrete pad. During well completion, the well identification nomenclature will be placed on or in the well protector. When the well pad has cured, a weep hole will be drilled in the protective outer casing just above the concrete pad so that moisture will not accumulated within the protective outer casing. Well completion details will be recorded on a permanent well completion record.

During drilling operations, soil and rock cuttings will be containerized and labeled properly. These cuttings will be stored on-site until proper disposal can be arranged. Drilling equipment will be decontaminated between each monitoring well location.

During well drilling/completion activities, samples of the silica sand, bentonite (pellets and powder), cement and any drill-fluid additives will be collected and archived for future analysis if needed.

Following well completion activities, each monitoring well will be left undisturbed for a minimum of 48 hours to allow the cement/bentonite grout to cure. After this 48-hour period, each of the newly installed monitoring wells will be developed to remove the fine particles that have accumulated in the well casing and annulus. The monitoring wells will be developed utilizing bailers, submersible pumps, surge-blocks or other suitable devices to ensure that the wells are free of suspended sediment and provide representative water samples. Development will be conducted until a minimum of three casing volumes are removed, the water quality parameters of the discharging groundwater are stable (within 10% variance) and the turbidity of the discharging groundwater is 20 NTU or less. All well development water will be containerized, properly labeled and stored on-site until proper disposal can be arranged.
Upon completion of well installation/completion activities, each monitoring well will be surveyed for horizontal and vertical control by an Oklahoma-licensed land surveyor (Jividens Land Survey Company, Woodward, Oklahoma). The coordinate location (within 1 foot), top of case elevation (TOC) (within 0.01 foot) and ground elevation (within 0.01 foot) for each monitoring well will be determined. In addition, to surveying, the location of each monitoring well will be recorded with a sub-meter GIS-compatible GPS.

Task 3 - Groundwater Monitoring
Upon completion of well development activities, the monitoring wells will be left undisturbed for a period of one week. Following this period, two rounds of concurrent depth to groundwater (DTW) measurements will be taken within each of the monitoring wells at the Site. The first DTW event will be conducted immediately prior to conducting groundwater purging/sampling activities, and the second DTW event will be conducted one week following the groundwater sampling event. The water levels will be measured from the surveyed TOC of each monitoring well utilizing a decontaminated electronic water level indicator and will be recorded in a dedicated field logbook. Data from the water level measurements, in conjunction with the TOC elevation data, will be utilized to construct groundwater potentiometric surface maps of the groundwater system being monitored.

Upon completion of well development activities and prior to conducting groundwater purging/sampling activities, vertical water quality logging will be conducted within each monitoring well. During these activities, the specific conductivity, temperature, dissolved oxygen (DO), pH and oxidation/reduction potential (Eh) of the groundwater will be measured on 1-foot increments from the top of the water column to the base of the monitoring well. These measurements will be recorded in a dedicated field logbook.

Reference data for the area indicate that the groundwater within the shallow terrace deposits likely exhibits density and/or chemical stratification. These data also suggest that the deep bedrock groundwater is also likely stratified. Therefore, it is anticipated that two groundwater samples will be collected from each of the monitoring wells completed at the Site. The groundwater sampling zones will be selected based upon the results of the vertical water quality logging conducted within each monitoring well.

Prior to conducting groundwater sampling within each selected zone, the zone will be low-flow purged utilizing a decontaminated bladder-pump with a dedicated bladder. Field measurements of pH, Eh, dissolved oxygen, specific conductance, temperature and turbidity will be collected and documented in a dedicated field logbook during well purging and immediately prior to sample collection. When three consecutive readings of the field parameters taken do not differ by more than 10%, and the turbidity of the discharging groundwater is 20 NTU or less, groundwater samples will be collected. If turbidity values of <20 NTU cannot be achieved, then dissolved analyses of metals, cations and radionuclides will be conducted. Upon collection, the groundwater samples will be placed directly into laboratory prepared sample containers, labeled as to source and contents, placed on wet-ice for preservation, and placed under chain-of-custody control for transport to the analytical laboratory (TestAmerica, Inc., Nashville, Tennessee) for analytical suite developed by Chesapeake for this investigation. This analytical suite is provided in attached Table 1.

All purge water and water not consumed during the sampling process will be containerized, properly labeled and stored on-site until proper disposal can be arranged.

Task 4 - Hydraulic Conductivity Testing
To further characterize the shallow unconfined groundwater system present beneath the Site, single-well displacement tests (slug) tests will be conducted in the 5 proposed shallow groundwater monitoring wells. During these slug tests, the groundwater within the well will be artificially lowered by rapidly removing groundwater from the well utilizing dedicated bailers. The return of the lowered groundwater level to an equilibrium level will be recorded utilizing a pressure transducer positioned at the bottom of the monitoring well attached to a data logger at the surface.

To further characterize the bedrock groundwater system, a 12-hour constant rate pump test followed by a 12-hour recovery monitored period will be conducted in the proposed deep monitoring well. A 1-hour pumping pre-test will be conducted on the well to determine pumping rate for the 24-hour test and will be conducted at least 1 day prior to the 24-hour test. The deep well will be outfitted with a pressure transducer positioned at the bottom of the monitoring well (placed in the well approximately 2 days prior to initiating pre-test activities) attached to a data logger at the surface to monitor drawdown. A pressure transducer will also be installed in the shallow monitoring well located adjacent to the deep monitoring well to measure any potential change/effect that pumping of the bedrock groundwater system may have upon the shallow groundwater system. Discharge measurements will be taken and the pH, specific conductivity and temperature of the discharging groundwater measured hourly throughout the pump test. A totalizing flow meter will be installed in the discharge line to monitor flow throughout the test.

Data from the pump and slug tests will be interpreted and values for hydraulic conductivity and transmissivity calculated, which will be used to estimate groundwater flow velocities.

Task 5 - Report Preparation
Upon completion of the field activities and receipt of the laboratory analytical data, SAIC will prepare a brief report detailing the results of the investigation. This report will describe the field operations and sampling activities conducted and will include the following:

- A brief discussion of the Site geology,
- A discussion of all field activities performed,
- A summary of results of the well installation activities,
- A discussion of the results of the deep geophysical logs,
- Tables summarizing the laboratory analytical data,
- A Site location and topographic features map,
- A Site map showing the actual locations of the newly installed monitoring wells,

- A depth to water map,
- Two groundwater potentiometric surface maps for the shallow groundwater system,
- Two cross sections (N-S and E-W),
- An evaluation of velocity of the shallow groundwater system beneath the Site,
- Soil boring and monitoring well construction records,
- Copies of the deep geophysical logs,
- Copies of field notes,
- Site photographs, and
- Laboratory analytical reports and chain-of-custody documentation.

A Cost Estimate to implement the scope of work is attached. SAIC's charges will be billed on a time-and-materials basis in accordance with the current Chesapeake/SAIC contract agreement.

SAIC appreciates this opportunity to be of service to Chesapeake. If you have any questions concerning the proposed scope of work or the estimated costs, please do not hesitate to contact me at (918) 599-4383.

Sincerely,
SAIC Energy, Environment & Infrastructure, LLC

Bruce McKenzie

Bruce E. McKenzie, P.G.
Project Manager

Attachments: Table 1 - Retrospective Case Study Analytical Suite
Figure 1 - Site Location and Topographic Features
Figure 2 - Proposed Gas Well Pad Site and Monitoring Well Locations
Cost Estimate

<u>Assumptions and Limitations</u>

In preparing the proposed Scope of Work (SOW) and Cost Estimate, SAIC has relied upon verbal and/or written information provided by Chesapeake Energy Corporation (Chesapeake) and/or secondary sources. SAIC has not been tasked to make an independent investigation concerning the accuracy or completeness of the information relied upon. To the extent that SAIC has based its proposed SOW and Cost Estimate on such information, the proposed SOW and Cost Estimate are contingent on the validity of the information provided.

Chesapeake acknowledges that SAIC has not contributed to the presence of hazardous substances, hazardous wastes, petroleum products, asbestos, chemicals, pollutants, contaminants, or any other hazardous or toxic materials (hereinafter Hazardous Materials) that may exist or be discovered in the future at the site at which SAIC's services shall be provided and that SAIC does not assume any liability for the known or unknown presence of Hazardous Materials.

SAIC's investigation will be restricted to collection and analyses of a limited number of environmental samples and visual observations obtained during the physical site visit, and from records made available by Chesapeake or third parties during the investigation. Because the investigation will consist of collecting and evaluating a limited supply of information, SAIC may not identify all potential items of concern. Therefore, SAIC warrants only that the project activities under this SOW and contract have been performed within the parameters and scope communicated by Chesapeake and reflected in the SOW and contract.

The proposed report will be prepared for the sole and intended use of Chesapeake. Any person or entity obtaining, using, or relying on this report hereby acknowledges that they do so at their own risk, and that SAIC shall have no responsibility or liability for the consequences thereof. This report is intended to be used in its entirety and taking or using in any way excerpts from the proposed report are not permitted and any party doing so does so at its own risk. In preparing this proposed report, SAIC will have relied on verbal and written information provided by secondary sources and interviews, including information provided by Chesapeake. Opinions and recommendations that may be presented in this report apply only to site conditions and features as they existed at the time of SAIC's site visit. The opinions and recommendations presented in this report cannot be applied to conditions and features of which SAIC is unaware and has not had the opportunity to evaluate.

Table 1 : Chesapeake Developed Groundwater Analytical Suite
Limited Hydrogeological Investigation
Alfalfa County, Oklahoma

Analyte	EPA Method	CHK's Lab Method
$\delta^{13}C$ and $\delta^{2}H$ of methane	Isotech: gas stripping and IRMS	Isotech: gas stripping and IRMS
$\delta^{13}C$ of inorganic carbon	Isotech: gas stripping and IRMS	Isotech: gas stripping and IRMS
$\delta^{86}Sr$ & $\delta^{87}Sr$	??	Geo Chron
Turbidity	NA	E180.1
Fecal Coliform	NA	SM20 9222D
Total Coliform	NA	SM20 9223B
MBAS	NA	SM5540C
Carbon Dioxide	RSKSOP-194v4& RSKSOP-175v5	SW8000B
Acetate	RSKSOP-112v6	SW8015
Butyrate	RSKSOP-112v6	SW8015
Formate	RSKSOP-112v6	SW8015
Isobutyrate	RSKSOP-112v6	SW8015
Lactate	RSKSOP-112v6	SW8015
Propionate	RSKSOP-112v6	SW8015
Diethylene glycol	Region III Method	SW8015
tetraethylene glycol	Region III Method	SW8015
triethylene glycol	Region III Method	SW8015
®-(+)-Limonene	ORGM 515r1.1	SW8270
1,2,4,5-Tetrachlorobenzene	ORGM 515r1.1	SW8270
1,2-Diphenylhydrazine (Azobenzene)	ORGM 515r1.1	SW8270
1,3-Dimethyl adamantine	ORGM 515r1.1	SW8270
1,3-Dinitrobenzene	ORGM 515r1.1	SW8270
1,4-Dinitrobenzene	ORGM 515r1.1	SW8270
1-Chloronaphthalene	ORGM 515r1.1	SW8270
2,3,4,6-Tetrachlorophenol	ORGM 515r1.1	SW8270
2,4,5-Trichlorophenol	ORGM 515r1.1	SW8270
2,4,6-Trichlorophenol	ORGM 515r1.1	SW8270
2,4-Dichlorophenol	ORGM 515r1.1	SW8270
2,4-Dimethylphenol	ORGM 515r1.1	SW8270
2,4-Dinitrophenol	ORGM 515r1.1	SW8270
2,4-Dinitrotoluene	ORGM 515r1.1	SW8270
2,6-Dichlorophenol	ORGM 515r1.1	SW8270
2,6-Dinitrotoluene	ORGM 515r1.1	SW8270
2-Butoxyethanol	ORGM 515r1.1	SW8270
2-Chloronaphthalene	ORGM 515r1.1	SW8270
2-Chlorophenol	ORGM 515r1.1	SW8270
2-Methylnaphthalene	ORGM 515r1.1	SW8270
2-Methylphenol	ORGM 515r1.1	SW8270
2-Nitroaniline	ORGM 515r1.1	SW8270

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Analyte	EPA Method	CHK's Lab Method
2-Nitrophenol	ORGM 515r1.1	SW8270
3,3-Dichlorobenzidine	ORGM 515r1.1	SW8270
3/4-Methylphenol	ORGM 515r1.1	SW8270
3-Nitroaniline	ORGM 515r1.1	SW8270
4,4'-Methylenebis (2-	ORGM 515r1.1	SW8270
4,4'-Methylenebis (N,N-dimethylaniline)	ORGM 515r1.1	SW8270
4,6-Dinitro-2-methylphenol	ORGM 515r1.1	SW8270
4-Bromophenyl phenyl ether	ORGM 515r1.1	SW8270
4-Chloro-3-methylphenol	ORGM 515r1.1	SW8270
4-Chloroaniline	ORGM 515r1.1	SW8270
4-Chlorophenyl phenyl ether	ORGM 515r1.1	SW8270
4-Nitroaniline	ORGM 515r1.1	SW8270
4-Nitrophenol	ORGM 515r1.1	SW8270
Acenaphthene	ORGM 515r1.1	SW8270
Acenaphthylene	ORGM 515r1.1	SW8270
Acetophenone	ORGM 515r1.1	SW8270
Adamantane	ORGM 515r1.1	SW8270
Aniline	ORGM 515r1.1	SW8270
Anthracene	ORGM 515r1.1	SW8270
Benzo (a) anthracene	ORGM 515r1.1	SW8270
Benzo (a) pyrene	ORGM 515r1.1	SW8270
Benzo (b) fluoranthene	ORGM 515r1.1	SW8270
Benzo (g,h,i) perylene	ORGM 515r1.1	SW8270
Benzo (k) fluoranthene	ORGM 515r1.1	SW8270
Benzoic acid	ORGM 515r1.1	SW8270
Benzyl alcohol	ORGM 515r1.1	SW8270
Bis(2-chloroethoxy)methane	ORGM 515r1.1	SW8270
Bis(2-chloroethyl)ether	ORGM 515r1.1	SW8270
Bis(2-chloroisopropyl)ether	ORGM 515r1.1	SW8270
Bis(2-ethylhexyl)phthalate	ORGM 515r1.1	SW8270
Butyl benzyl phthalate	ORGM 515r1.1	SW8270
Carbazole	ORGM 515r1.1	SW8270
Chloroaniline	ORGM 515r1.1	SW8270
Chlorobenzilate	ORGM 515r1.1	SW8270
Chrysene	ORGM 515r1.1	SW8270
Diallate (cis or trans)	ORGM 515r1.1	SW8270
Dibenz (a,h) anthracene	ORGM 515r1.1	SW8270
Dibenzofuran	ORGM 515r1.1	SW8270
Diethyl phthalate	ORGM 515r1.1	SW8270
Dimethyl phthalate	ORGM 515r1.1	SW8270

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Alfalfa County, Oklahoma

Analyte	EPA Method	CHK's Lab Method
Di-n-butyl phthalate	ORGM 515r1.1	SW8270
Di-n-octyl phthalate	ORGM 515r1.1	SW8270
Dinoseb	ORGM 515r1.1	SW8270
Diphenylamine	ORGM 515r1.1	SW8270
Disulfoton	ORGM 515r1.1	SW8270
Fluoranthene	ORGM 515r1.1	SW8270
Fluorene	ORGM 515r1.1	SW8270
Hexachlorobenzene	ORGM 515r1.1	SW8270
Hexachlorobutadiene	ORGM 515r1.1	SW8270
Hexachlorocyclopentadiene	ORGM 515r1.1	SW8270
Hexachloroethane	ORGM 515r1.1	SW8270
Indeno (1,2,3-cd) pyrene	ORGM 515r1.1	SW8270
Isophorone	ORGM 515r1.1	SW8270
Naphthalene	ORGM 515r1.1	SW8270
Nitrobenzene	ORGM 515r1.1	SW8270
N-Nitrosodiethylamine	ORGM 515r1.1	SW8270
N-Nitrosodimethylamine	ORGM 515r1.1	SW8270
N-Nitrosodi-n-butylamine	ORGM 515r1.1	SW8270
N-Nitrosodi-n-propylamine	ORGM 515r1.1	SW8270
N-Nitrosodiphenylamine	ORGM 515r1.1	SW8270
N-Nitrosomethylethylamine	ORGM 515r1.1	SW8270
Parathion	ORGM 515r1.1	SW8270
Parathion-ethyl	ORGM 515r1.1	SW8270
Parathion-methyl	ORGM 515r1.1	SW8270
Pentachlorobenzene	ORGM 515r1.1	SW8270
Pentachlorophenol	ORGM 515r1.1	SW8270
Phenanthrene	ORGM 515r1.1	SW8270
Phenol	ORGM 515r1.1	SW8270
Phorate	ORGM 515r1.1	SW8270
Pronamide	ORGM 515r1.1	SW8270
Pyrene	ORGM 515r1.1	SW8270
Pyridine	ORGM 515r1.1	SW8270
Squalene	ORGM 515r1.1	SW8270
Terbufos	ORGM 515r1.1	SW8270
Terpiniol	ORGM 515r1.1	SW8270
Tri(2-butoxyethyl)phosphate	ORGM 515r1.1	SW8270
Trifluralin	ORGM 515r1.1	SW8270
Carbaryl	ORGM 515r1.1	SW8270 (EPA531.1 optional)
1,2-Dinitrobenzene	ORGM 515r1.1	SW8270 (SW8330 optional)

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Alfalfa County, Oklahoma

Analyte	EPA Method	CHK's Lab Method
Bromide	RSKSOP-276v3	SW9056
Chloride	RSKSOP-276v3	SW9056
Fluoride	RSKSOP-276v3	SW9056
Nitrate	RSKSOP-214v5	SW9056
Nitrite	RSKSOP-214v5	SW9056
Sulfate	RSKSOP-276v3	SW9056
Hydrogen	RSKSOP-194v4& RSKSOP-175v5	??
BART Kit (IRB,SRB,SFB)	NA	BART
Diesel	ORGM 508 r 1.0	SW8015
GRO as Gasoline	ORGM 506 r 1.0	SW8015
Oil & Grease HEM	NA	E1664A
Temperature of pH determination	NA	E170.1
Phosphorus	RSKSOP-213v4	E365.4
Dissolved Organic Carbon (DOC)	RSKSOP 330v0	SW9060 or SM20 5310C / 415.1M
Acetylene	RSKSOP-194v4 & RSKSOP-175v5	RSK175
Butane	RSKSOP-194v4& RSKSOP-175v5	RSK175
Ethane	RSKSOP-194v4& RSKSOP-175v5	RSK175
Ethylene	RSKSOP-194v4 & RSKSOP-175v5	RSK175
Methane	RSKSOP-194v4 & RSKSOP-175v5	RSK175
Propane	RSKSOP-194v4& RSKSOP-175v5	RSK175
Alkalinity, Total (CaCO3)	NA	SM2320B
Bicarbonate Alkalinity as CaCO3	NA	SM2320B
Carbonate as CaCO3	NA	SM2320B
Specific conductance	NA	SM2510B
Total Dissolved Solids	NA	SM2540C
Total Suspended Solids	NA	SM2540D
pH	NA	SM4500HB
Dissolved Inorganic Carbon (DIC)	RSKSOP 330v0	SW9060 or Standard Methods (SM20) or equivalent
Ammonia as N	RSKSOP-214v5	SM4500NH3BG
Silicon	RSKSOP-213v4	SW6010
Boron	RSKSOP-213v4	SW6010C
Magnesium	RSKSOP-213v4	SW6010C
Potassium	RSKSOP-213v4	SW6010C
Sodium	RSKSOP-213v4	SW6010C

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Alfalfa County, Oklahoma

Analyte	EPA Method	CHK's Lab Method
Strontium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6010C
Sulfur	RSKSOP-213v4	SW6010C
Calcium	RSKSOP-213v4	SW6010C
Aluminum	RSKSOP-213v4	SW6020
Antimony	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Arsenic	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Barium	RSKSOP-213v4	SW6020
Beryllium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Cadmium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Cesium	RSKSOP-257v3/-332v0	SW6020
Chromium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Cobalt	RSKSOP-213v4	SW6020
Copper	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Iron	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Lead	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Manganese	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Molybdenum	RSKSOP-213v4	SW6020
Nickel	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Potassium		SW6020
Selenium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Silver	RSKSOP-213v4	SW6020
Thallium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Thorium	NA	SW6020
Titanium	RSKSOP-213v4	SW6020
Uranium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Vanadium	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020
Zinc	RSKSOP-213v4 / RSKSOP-257v3/-332v0	SW6020

Table 1 : Chesapeake Developed Groundwater Analytical Suite
Limited Hydrogeological Investigation
Alfalfa County, Oklahoma

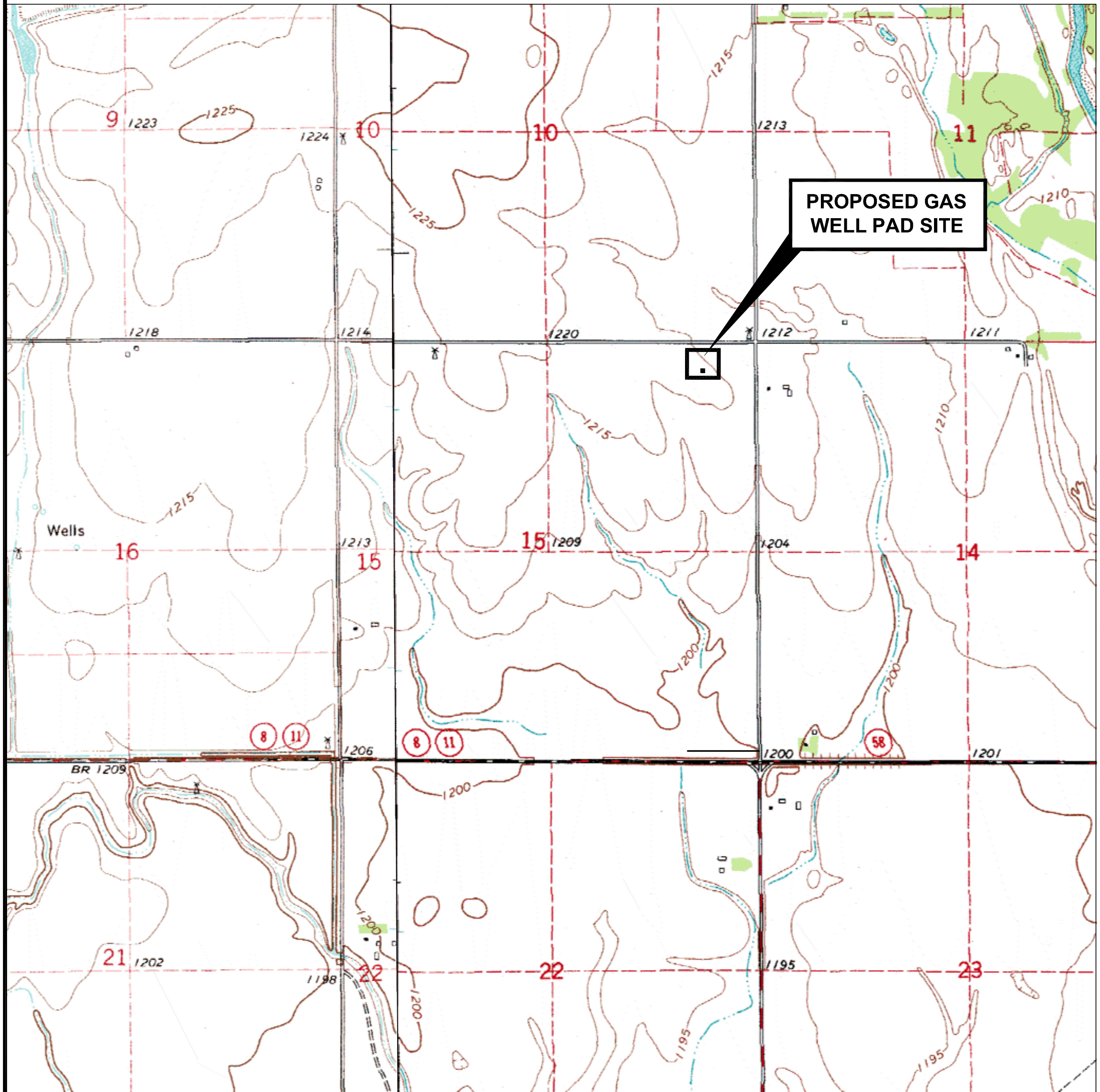
Analyte	EPA Method	CHK's Lab Method
Mercury	RSKSOP-257v3/-332v0	SW7470A
1,2-Dibromo-3-chloropropane	ORGM 515r1.1	SW8011
4,4'-DDD	ORGM 515r1.1	SW8081
4,4'-DDE	ORGM 515r1.1	SW8081
4,4'-DDT	ORGM 515r1.1	SW8081
Aldrin	ORGM 515r1.1	SW8081
Dieldrin	ORGM 515r1.1	SW8081
Endosulfan I	ORGM 515r1.1	SW8081
Endosulfan II	ORGM 515r1.1	SW8081
Endosulfan sulfate	ORGM 515r1.1	SW8081
Endrin	ORGM 515r1.1	SW8081
Endrin aldehyde	ORGM 515r1.1	SW8081
Endrin ketone	ORGM 515r1.1	SW8081
Heptachlor	ORGM 515r1.1	SW8081
Heptachlor epoxide	ORGM 515r1.1	SW8081
Methoxychlor	ORGM 515r1.1	SW8081
α-BHC	ORGM 515r1.1	SW8081
β-BHC	ORGM 515r1.1	SW8081
γ-BHC (Lindane)	ORGM 515r1.1	SW8081
δ-BHC	ORGM 515r1.1	SW8081
Azinphos-methyl	ORGM 515r1.1	SW8141
Dichlorovos	ORGM 515r1.1	SW8141
Malathion	ORGM 515r1.1	SW8141
Mevinphos	RSKSOP-213v4	SW8141
1,1,1-Trichloroethane	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,1,2-Trichloroethane	RSKSOP-299v1	SW8260B
1,1-Dichloroethane	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,1-Dichloroethene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,2,4-Trimethylbenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,2-Dibromo-3-chloropropane	NA	SW8260B
1,2-Dichlorobenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,2-Dichloroethane	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,3,5-Trimethylbenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,3-Dichlorobenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
1,4-Dichlorobenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Acetone	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Benzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Carbon disulfide	RSKSOP-299v1	SW8260B
Carbon Tetrachloride	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Chlorobenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B

Table 1 : Chesapeake Developed Groundwater Analytical Suite
Limited Hydrogeological Investigation
Alfalfa County, Oklahoma

Analyte	EPA Method	CHK's Lab Method
Chloroform	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
cis-1,2-Dichloroethene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Diisopropyl ether	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Ethanol	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Ethyl t-butyl ether	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Ethylbenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Isopropyl Alcohol	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Isopropyl benzene	RSKSOP-299v1	SW8260B
m/p-Xylene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Methyl t-butyl ether	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Methylene Chloride	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Naphthalene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
o-Xylene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
t-Amyl methyl ether	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
t-Butyl alcohol	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Tetrachloroethene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Toluene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
trans-1,2-Dichloroethene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Trichloroethene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Vinyl chloride	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Xylenes, total	NA	SW8260B
1,2,3-Trimethylbenzene	RSKSOP-259v1 / RSKSOP-299v1	SW8260B
Radiochemistry: Gamma Spectroscopy	NA	EPA 901.1
Radiochemistry: Ra 226	NA	EPA 903.0
Radiochemistry: Ra 228	NA	EPA 904.0
Radiochemistry: Gross Alpha	NA	SW9310
Radiochemistry: Gross Beta	NA	SW9310

Footnotes:
NA = Not Analyzed

R 11 W



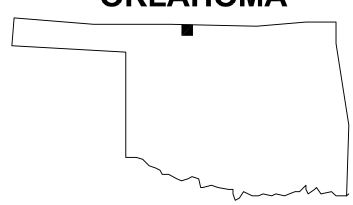
T 28 N

SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLES
BURLINGTON, OKLA.-KANS. - 1969 AND
AMORITA, OKLA.-KANS. - 1969

SCALE

0 1/2 1 MILE

OKLAHOMA



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SAIC

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www.SAIC.com/EEandI

FIGURE TITLE	***SITE LOCATION AND TOPOGRAPHIC FEATURES***
DOCUMENT TITLE	PROPOSAL FOR LIMITED HYDROGEOLOGICAL INVESTIGATION
CLIENT	CHESAPEAKE ENERGY CORPORATION
LOCATION	SECTION 15, TOWNSHIP 28 NORTH, RANGE 11 WEST ALFALFA COUNTY, OKLAHOMA

DATE	4/23/2012
SCALE	AS SHOWN
DESIGNED BY	BEM
APPROVED BY	BEM
DRAWN BY	SKG
PROJECT NUMBER	
2602299041	
FIGURE NUMBER	
1	

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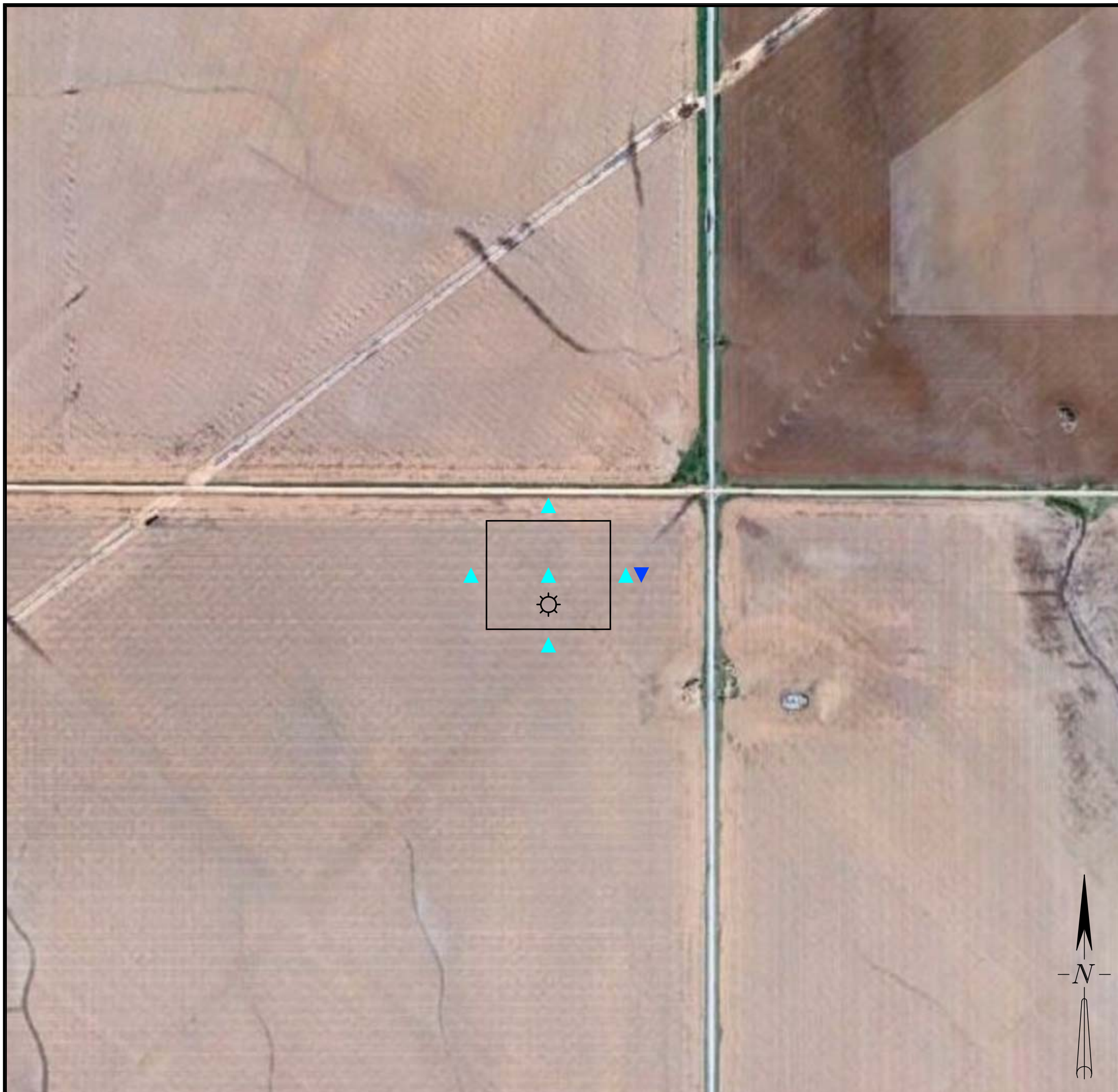

SOURCE: AERIAL DATED SEPTEMBER 2011 - SCREEN CAPTURE FROM GOOGLE EARTH PRO

LEGEND

- ☼ PROPOSED GAS WELL LOCATION
- ▲ PROPOSED SHALLOW GROUNDWATER MONITORING WELL LOCATION
- ▼ PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATION
- ▭ PROPOSED LOCATION OF WELL PAD / DISTURBED AREA

250 0 250 500
SCALE FEET

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Tulsa, Oklahoma 74103
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FIGURE TITLE	***PROPOSED GAS WELL PAD SITE AND MONITORING WELL LOCATIONS***
DOCUMENT TITLE	PROPOSAL FOR LIMITED HYDROGEOLOGICAL INVESTIGATION
CLIENT	CHESAPEAKE ENERGY CORPORATION
LOCATION	SECTION 15, TOWNSHIP 28 NORTH, RANGE 11 WEST ALFALFA COUNTY, OKLAHOMA

DATE	4/23/2012
SCALE	1"= 500'
DESIGNED BY	BEM
APPROVED BY	BEM
DRAWN BY	SKG
PROJECT NUMBER	2602299041
FIGURE NUMBER	2

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